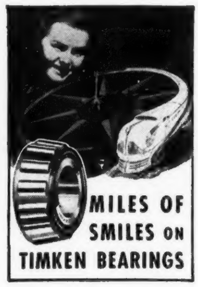
THE CORNELL ENGINEER

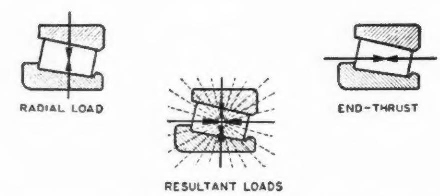
November, 1940
Volume 6—Number 2

COLLEGE OF ENGINEERING · CORNELL UNIVERSITY

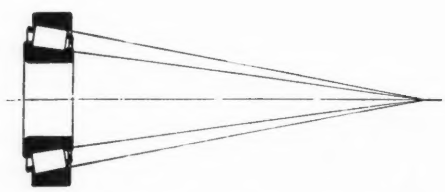
HERE'S WHY THE TIMKEN BEARING SUCCESSFULLY MEETS EVERY MODERN BEARING REQUIREMENT . . .



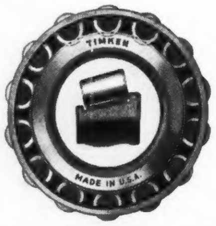
The fundamental characteristics of the TIMKEN Bearing, arising from inherent features of its design, make this bearing eminently suitable for every bearing application in every kind of mechanical equipment. In your future years as an engineer, bearing selection will be one of your many important responsibilities. The more you learn about bearings now, the easier your task will be.



The most important feature of the TIMKEN Bearing is its basic tapered principle, introduced by Timken in 1898 and never superseded. This enables the bearing to carry all types of loads—radial, thrust or both together in any combination—without auxiliary supports of any kind, (such as thrust plates or thrust washers).



To assure true rolling motion and thus provide maximum anti-friction efficiency in operation, the bearing is so designed that lines projected along the tapered surfaces of the rolls and races meet at a common apex on the axis of the bearing.



Rolls are kept in exact alignment with respect to the races by two area contact of the large roll ends with the undercut rib of the cone (inner race).

A scientifically-designed and accurately-perforated cage keeps the rolls properly spaced around the cone so that each roll carries its proper proportion of the load.

For more than 41 years a constant process of engineering refinement has been going on, resulting in the perfected TIMKEN Bearing of today—a product of one of the world's largest and most famous engineering-manufacturing organizations.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; and TIMKEN Rock Bits.

TIMKEN
TAPERED ROLLER BEARINGS


LUFKIN CHROME FACE
"RANGER"
ENGINEERS TAPE

Editor's Column

If you were to examine the scholastic averages of the members of the classes in the engineering college, particularly those of the seniors, and at the same time look up the activities of each student, you would find, as I did, that those who stand up at the top in scholarship are those who are engaged in the outside activities. This may indicate that it takes a very intelligent person to carry on both school and outside activities or it may indicate, as I like to think, that the student who does carry on outside activities learns how to employ his time to the best advantage in that having used up much of his leisure time on other activities, he realizes that in the time remaining he must study.

The point I want to make is that a student is better off by having outside activities, because they not only help to broaden him but also help him to receive better grades.

In answer to several queries, the illustration on last month's cover was taken during the last Cornell Day Engineering Show and shows the Cornell Day visitors examining the glider that was on exhibit. This month's cover is a view of the newest proposed engineering building models taken from a point near the site of the present law school on the model.

During the past month alterations have been going on in West Sibley. The sound of hammers and saws and the poignant smell of paint have been vieing with the professors' and instructors' voices for the attention of the students. Several of our AE professors have been moved upstairs in a literal sense to new offices.

The Student Engineering Council which did such a fine job last year on the running of the engineering show Cornell Day has already started to plan for the show this coming year. Last year, the council with some help on the part of the college, financed the show. This year they hope to finance it themselves. Their main source of income has been the Engineers' Dance, and by scheduling well in advance this year they hope to make enough more to pay all expenses.

In our December issue we are going to write up Professor Goodier, a write-up which we have reason to believe will be very timely. Football enthusiasts will have reason to read our student write-ups, for one will be about Al Kelly, at present starring on Cornell's football team; and the other on Ted White, the manager of the football team. Our third student will be Gergoe Gentes, one of our outstanding Chemical Engineering students. Those readers interested in photoelasticity will welcome Professor Cuykendall's article describing the work he has done with gelatine models on photoelasticity. Watch for it.

The CORNELL ENGINEER

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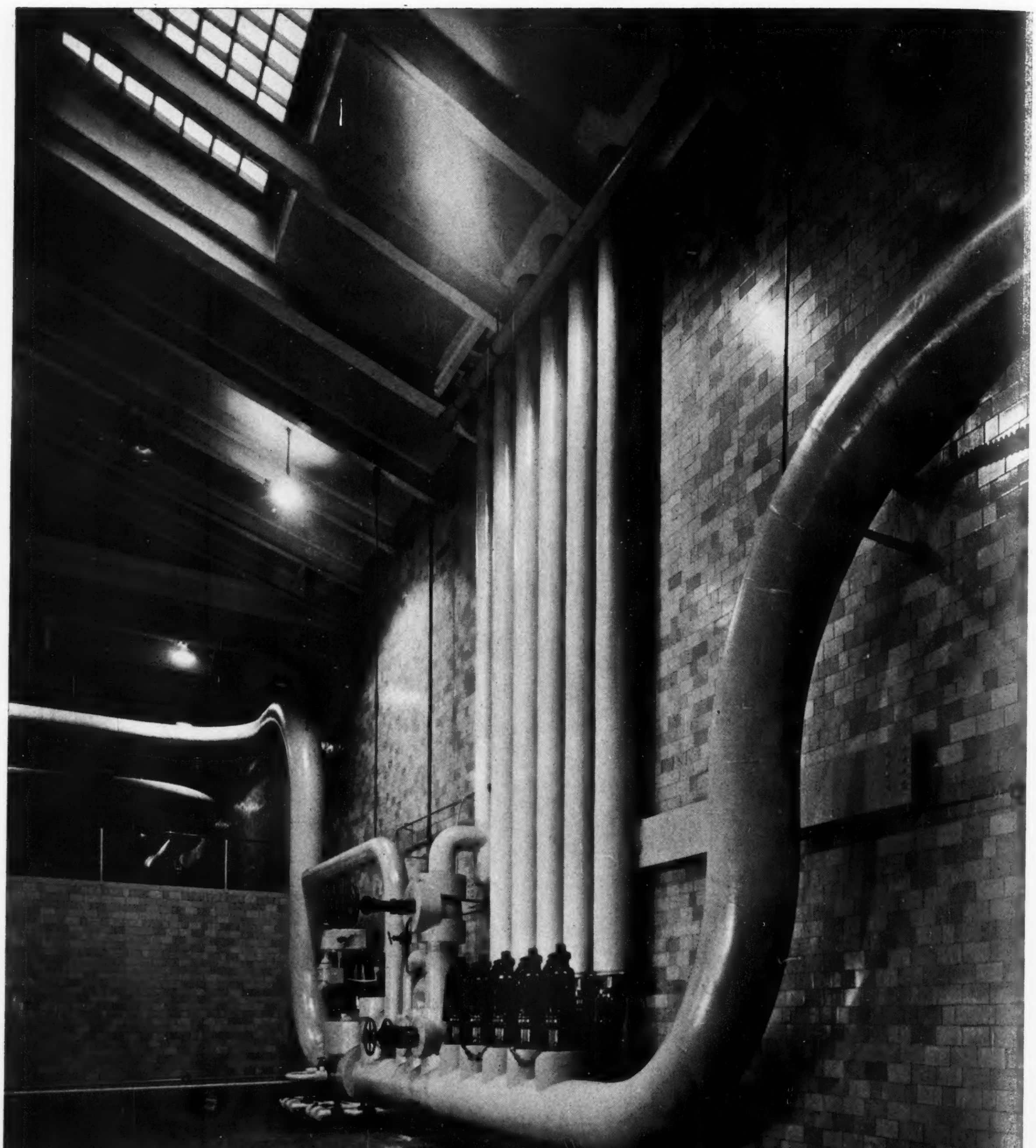


—*Courtesy Detroit Edison Company*

Relief-valve Manifold on the Superposed Turbine Exhaust . . . the Connecting Link Between the Plant Extension and Low-pressure Turbines.

Design of Steam-Electric Generating Plants

P. W. THOMPSON, M.E. '10

FEW of us ever allow our thoughts to dwell upon the far-reaching sociological effects produced through the development of electric service. We are, however, the fortunate witnesses of the arrival and development of new methods of lighting, transportation, and sources of domestic and industrial power, all of which have far-reaching effects upon our present-day manner of living.

The situation, with respect to our electric service as we know it today, has been made possible through the combined efforts of many different groups of individuals carrying on the necessary related endeavors to make available to a large part of our people electric service at low cost.

All branches of engineering have played important parts in this great development, but the limitations of this article prevent dwelling upon their widespread contributions.

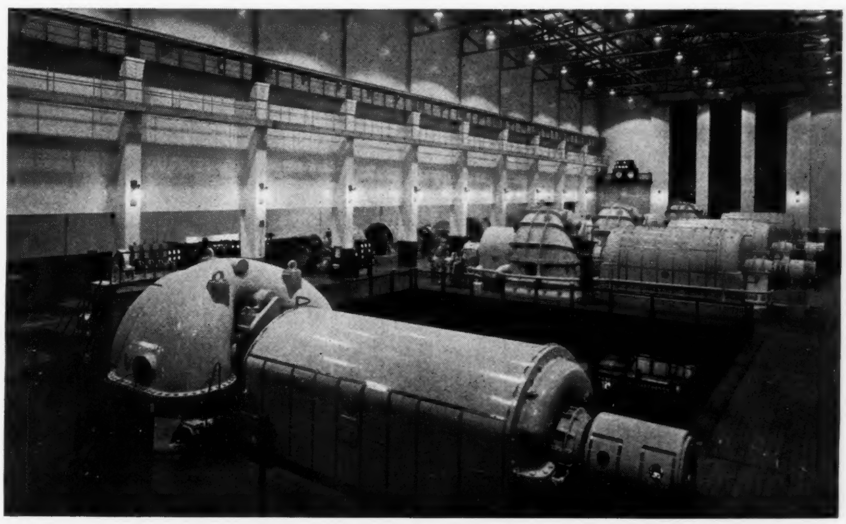
From an engineering standpoint, the power plant designer has made and is making valuable contributions to progress in the art. There have been times over the past forty or so years that the art has seemed to be stabilized, but not for long. Today, improvements in materials and processes are becoming available at a rapid rate and no one can predict what the well-designed power plant of the future will be.

The design and construction of steam-electric generating facilities naturally follow a need for such facilities, either present or expected. If, as we shall assume, an entirely new plant is to be built, there are many factors to be considered before the preliminary decisions necessary to permit starting the design can be reached.

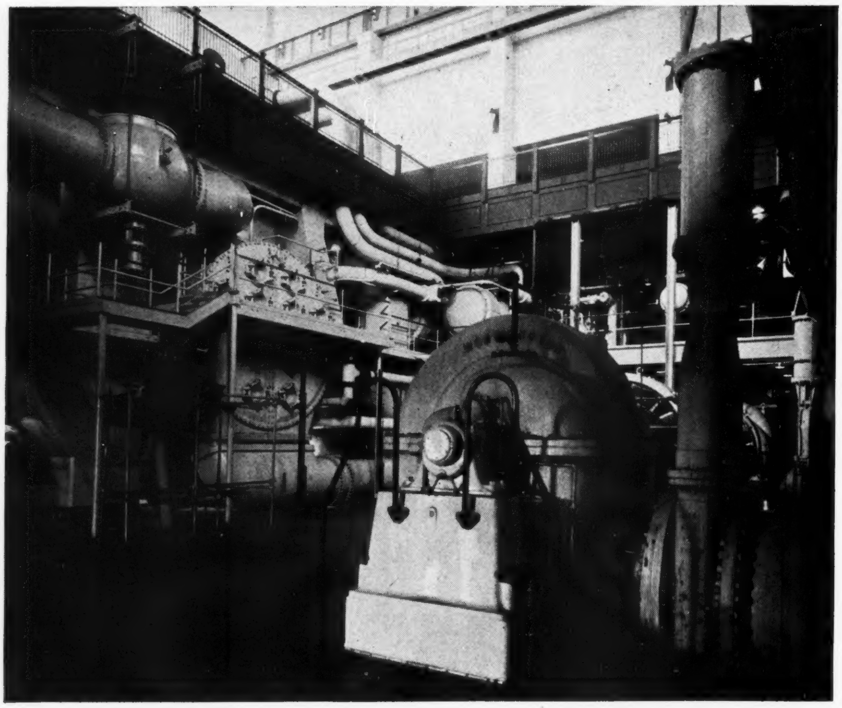
After graduating from Cornell in 1910 with the degree of Mechanical Engineer, Mr. Thompon remained as an instructor at Sibley College under Professor Barnard. During the summer months of the three years he spent as an instructor, he worked with the McIntosh Seymour Corporation of Auburn, New York, designing steam engines.

At the present time the author is Chief Engineer of Power Plants for the Detroit Edison Company, in charge of the operation and maintenance of all the company's steam-electric-generating facilities, which comprise 1,085,000 kilowatts of installed capacity. Mr. Thompson started working for the Detroit Edison Company in 1913 and has had various duties in power plant operation, maintenance, and testing.

First, consideration should be given to the immediate and future size of the plant. Central Station power plants are practically never constructed to their full ultimate size and capacity in one project. A consideration of the character of the load—that is, the daily, seasonal, and annual load factor, the amount of load to be served reasonably soon (say two years), and the expected rate of growth may indicate that the plant should be designed for an ultimate three to four hundred thousand kilowatts. As it takes about two years from the inception of a power-plant project before it can be made ready to serve, it is usually customary to put in the substructure and plant building to accommodate more than the equipment to be installed as a first step. It might be decided that an ultimate capacity of 375,000 kw. should be provided for with the immediate installation of complete equipment for one 75,000-kw. turbo-generator. In such a case it is likely that the substructure and building would be constructed to



General View of Delray Turbine Room. 75,000 Kw. Unit in Foreground. Two of the 4,000 Kw. d.c. House-Service Machines Are Invisible in the Background.



General View of 75,000 Kw. Unit 14 from Condenser Room Floor, Showing Turbine-exhaust Hood, Condenser, Steam-extraction, Lines and Two High Pressure Feed-Water Heaters

accommodate the equipment for two such machines, or possibly three, in order to provide a so-called open-end plant wherein additional generating capacity can be added in a shorter period of time than would be required if substructure and plant buildings had to be provided at the time of making the next addition.

In selecting the location there are several requirements to be fulfilled, few of which are subject to theoretical solution. It is, of course, an advantage if the site selected is reasonably close to the center of load, but other restrictions rarely permit more than an approximation in this respect. The necessity of having available large quantities of water to supply the condensers is probably the first consideration, so that if a large lake or river is within reasonable distance of the area to be served the plant should be located near its shore line. The matter of tax rate must not be overlooked, because another location where the tax rate is lower might be a deciding factor when considering two or more possible sites. In nearly all cases, the site should be so located that railroad service can be made available for the delivery of building materials, equipment, and fuel. Assurance should be obtained that sufficient property adjoining the site is available for the outgoing cables or overhead lines for getting the energy away from the station. The soil conditions for foundations, the facilities for building the plant (both as regards labor and material), and storage facilities for fuel all enter into the logical selection of a plant site.

Concurrently with these moves in selecting and acquiring the plant site, the engineers have probably been making studies, the results of which will indicate a choice of steam pressure and temperature. The use factor under which the plant will operate over its expected life will be an important consideration in making this decision. Since the cost of a highly efficient plant is greater than for a less efficient one, it will prove more economical to design for high efficiency when there is promise of operating at a high load factor and for less efficiency when the load factor is low. An average load factor of between 40 and 50 per cent over the useful life of a plant may be considered as very good. Should this be one of several plants feeding into a large system, it will probably be operated at a much higher load factor over the first few years of its life or until it ceases to be capable of more efficient generation than the capacity which may be added at some later date. The probable future cost of fuel may also have an important influence. At this writing, the so-called Guffey Act, which will set coal costs materially higher, has not been put into effect, and the date when the Act will become effective is unknown. However, although prices even in the immediate future are unpredictable, the assumption that coal probably will not be less than at present is safe.

The capacity of the plant and the size of the prime movers having been decided, the capacity of the boilers can readily be determined. If the plant is to be of the unit type—that is, one boiler connected directly to one turbine, the matter is very simply settled. Many plants are being built however, wherein a cross steam-connection is provided between boilers and sufficient boiler capacity provided so that full plant output can be obtained with one or possibly two (in the case of smaller boiler units) boilers out of service. This latter arrangement provides full steam requirements even during the annual inspection and repairs to the steam-generating units.

Data as to the dimensions and weights of the turbo-generators and the boilers, together with superheater, economizers, and preheaters, can now be obtained from the manufacturers and the layout of the power house can be made. With a general knowledge of the size and number of items of auxiliary equipment the building dimensions may be established and the location of the main supporting steel columns set.

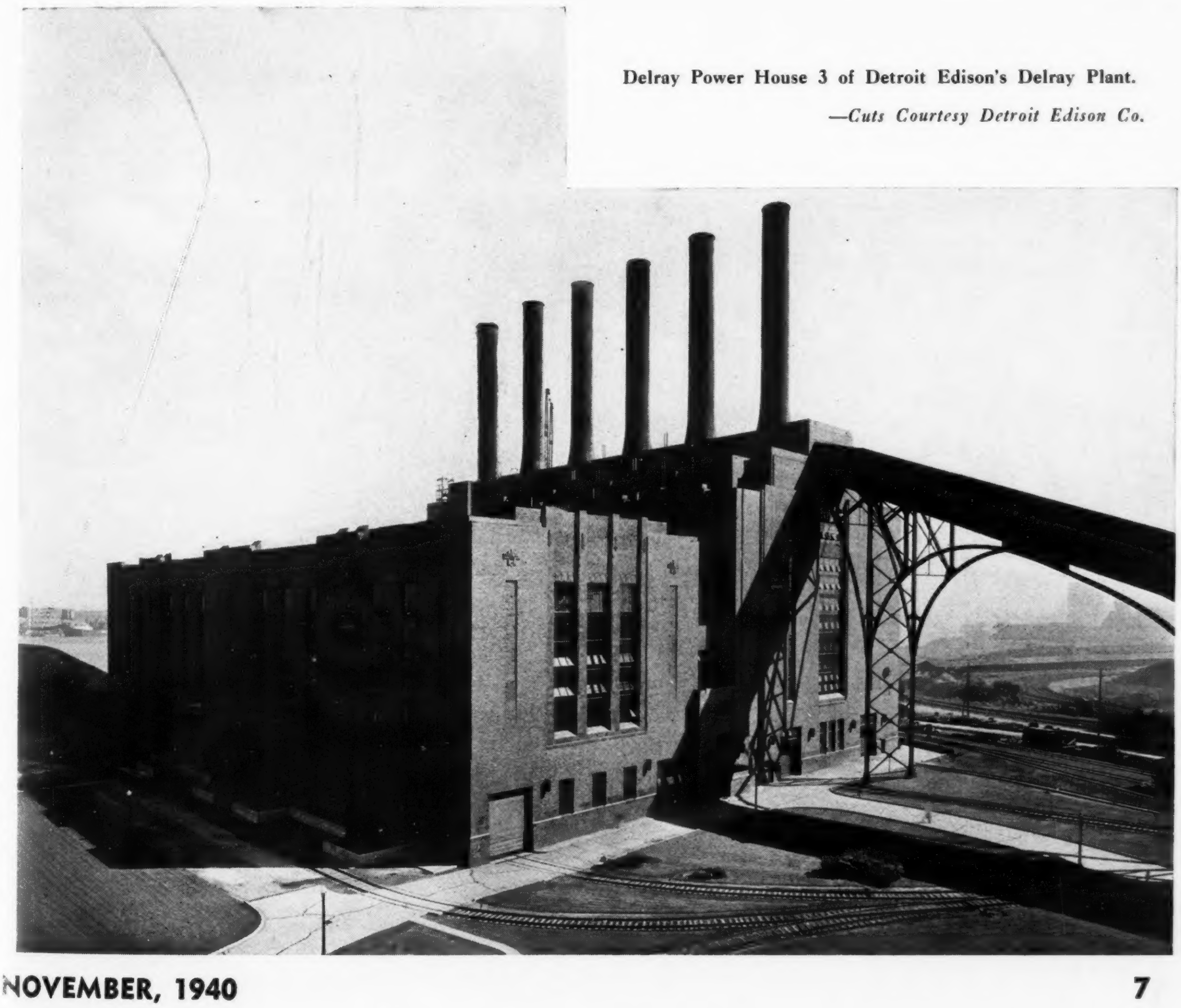
Knowing the weights and approximate locations of the equipment to be installed, the design of the substructure can now progress. The intake and overflow canals which carry the condensing water must be included; if the plant is located in a part of the country where severe ice conditions exist in winter, a recirculating canal for carrying a portion of the warmed condensing water back and ahead of the trash racks or screens will be of real value in protecting against a possible shut-down under certain winter weather conditions.

A building design which permits symmetry of arrangement of all details of successive units and a liberal provision of space around all equipment which must be attended and serviced are things which contribute to good operating conditions. The designer should exercise his ingenuity to provide those things which the operating force consider to be important in the performance of their duties so that the best possible operating results can be obtained in practice.

The architectural features of the building should be such as to harmonize with and add to the beauty of the surrounding community. A simple treatment by the architect which involves no unnecessary expense is to be recommended.

Foundations and walls which are of reinforced concrete should be continued several feet above grade. Usually brick supported by structural steel is used for completing the walls, although reinforced concrete, hollow tile or stone, or a combination of these materials may be employed. The main floors are usually of reinforced concrete with intermediate floors and walkways of steel gratings. The use of a light-colored tile or glazed brick for the inside walls is favored in that a better light diffusion is obtained thereby, and they are more easily cleaned.

Even though large quantities of heat may be radiated from boilers, piping, and other equipment, it must be remembered that an enormous quantity of air is taken into the furnaces for combustion purposes; so particular attention should be given to proper arrangement for heating and ventilating the building. Provision must be made to admit the large amount of air required for combustion, but this is difficult to accomplish without creating drafts which are uncomfortable for the operators. Furthermore, in severe winter weather there is the ever-present danger of freezing important water services. The best means of averting this danger is to admit the air in small quantities in as many places as possible and in a manner which will not produce discomfort to the operators. A certain amount of



Delray Power House 3 of Detroit Edison's Delray Plant.

—Cuts Courtesy Detroit Edison Co.

fixed radiation on the walls near the main operating floors is required, but this may be supplemented advantageously by the use of unit heaters in isolated places.

In many instances, plants are designed to burn more than one class of fuel. On the Atlantic Seaboard many plants are designed to burn either coal or oil. In the Southwest and parts of the Midwest, natural gas is available and is sometimes the main source of fuel. The greater portion of electric generation, however, is from coal.

During the last decade the burning of coal in pulverized form has increased greatly, although many plants are continuing the use of mechanical stokers. There are two principal advantages held by the pulverized-fuel method—namely, the ability to burn economically coals having a rather wide range of quality, and the ability to increase the fuel-burning rate in a single boiler unit. If stokers are selected, the choice of type will depend upon the burning characteristics of the grade of coal commercially available. If the pulverized-coal method is chosen there are several different systems to consider in selecting the most appropriate and economical one for the fuel to be burned.

Coal deliveries are by rail or water or both. All plants burning coal or oil carry a reserve supply in storage as a protection against an interruption of deliveries resulting from strikes, floods, shortage of transportation facilities, or other emergencies. Means for handling the fuel to and from storage as well as the transportation to the plant may involve several kinds of equipment such as locomotive cranes for loading and unloading to and from storage piles, cars for transporting to the plant, receiving hopper, and crushers and conveyors for reducing the coal to the proper size and distributing to the supply bunkers located over the boilers.

At the time of installing the first of several generating units, a duplicate system of coal conveying and crushing should be installed so that a breakdown of any single part will not require taking the plant out of service while making repairs for lack of coal. In the completed plant there will probably be installed sufficient conveying equipment to supply the fuel requirements during one eight-hour shift per day when operating under full plant load. When breakdowns occur, or when it is necessary to take equipment out of service temporarily for maintenance purposes, longer hours' operation of the remaining coal-handling equipment may be required to keep the bunkers supplied.

The energy for driving the many pieces of auxiliary equipment may be derived from several sources. Steam turbines are frequently used on the most essential equipment such as boiler feed pumps. The main advantages are that such steam-turbine-driven equipment is not subject to stoppage during times of electrical trouble and also it affords a convenient means of obtaining speed adjustment. Even in cases where motor-driven feed pumps are used in normal operation, a steam-turbine-driven standby feed pump or pumps sufficient to supply the boilers with water are considered necessary to protect the boilers against a possible shortage of water.

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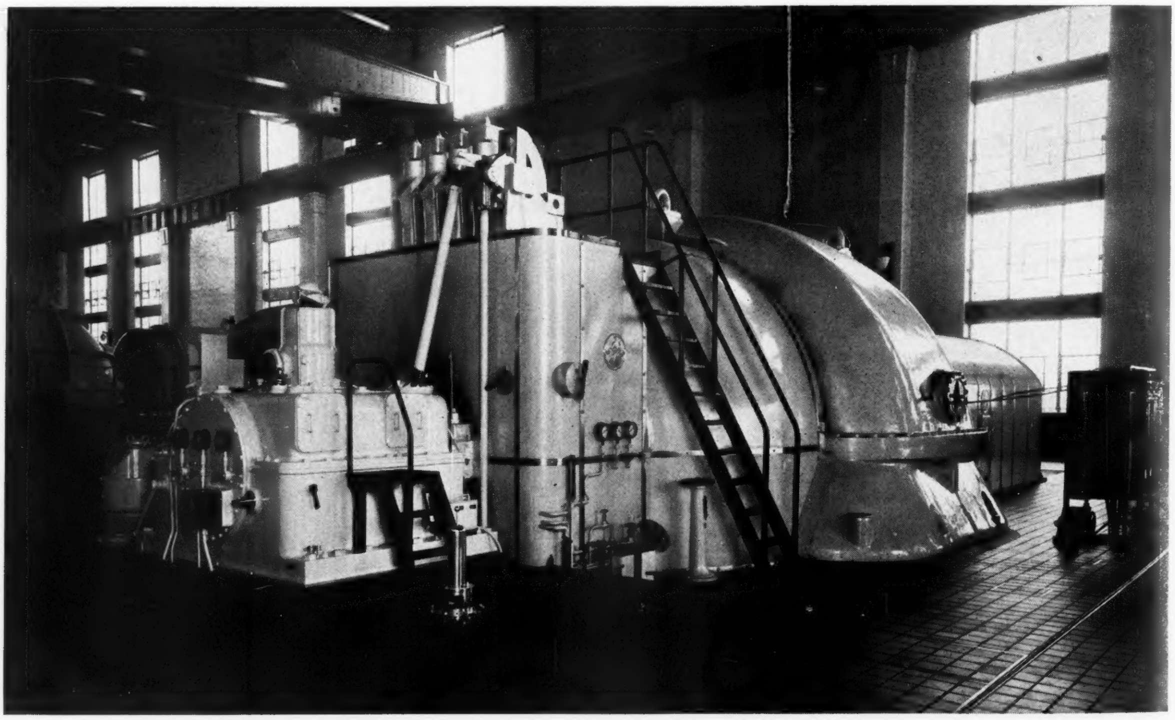

View of Completed 75,000 Kw. Turbogenerator Unit 14. The Instrument on the Extreme Right Is An Absolute Pressure Gauge Used In Special Test Work.

Vitamin A Applied To Human Needs

CARLTON DEEDERER, M.S., M.D.

"The year I had in Sibley enabled me to perfect the instrument known as the vitamin-A-scope, described in the enclosed article in the hopes that many who read the article can in some way be benefited or possibly advance the art."

So writes Dr. Carlton Deederer, formerly a student in the Engineering College at Cornell, in the class of 1904. Later a member of the staff of the Mayo Clinic, Dr. Deederer is now engaged in practice in Miami, Florida.

DEAN Hollister's words in THE CORNELL ENGINEER, May, 1940, stating the difficulties of making basic inventions today, suggest that we should promulgate the general knowledge of our near basic patents.

It has now become possible to standardize vitamin A in terms of human units by the use of a new instrument, a vitamin-A-scope, which gives readings interpretable in the needs of man versus those of rats, which are quite incomparable to human beings. By gazing for only 20 seconds at a circle of light of 75 lamberts brightness, sufficient vitamin A (visual purple precursor) is exhausted from the retina to cause a delay in visual perception of a letter of certain size and illuminated by a fraction of the original source of light. The length of time required for glare-recovery is in a direct proportion to deficiency of vitamin A in the circulation available to replace that used up in viewing that particular light.

It therefore has been possible to reduce such readings to human terms by considering certain factors. Making use of a vitamin A compound (oleum carchari) extracted from certain sharks (most frequently *Sphyrna zygoena*) of the Gulf Stream in our laboratory it was established that when a certain strength of oil was used and administered to an individual who was just showing deficiency of a certain degree, his reading on vitamin-A-scope No. 1 type (produced in our laboratory) dropped from 10 to 4, observed the second time in 24 days.

Furthermore, after having continued this treatment for a number of months the subject who had been beginning to have white hairs on the sides of his head and a marked advancing presenile alopecia on top began to grow hair more abundantly and all in the natural color.

Vitamin-A-Scope

While similar results in varying degrees were observed in numerous other cases it was deemed advisable to name the number of human units which would produce such results. This has been given as "10" partly because of its metric type of nomenclature and also because it facilitated adequate latitude for dosage without running into high numbers.

After having studied hundreds of cases of focal infection especially of dental origin reported here it was conceived that a cause beside dietary deficiency might exist and surely enough, it was found that cases of dental foci such as partially devital teeth or an irritated cervix uteri showed varying degrees of marked deficiency of bodily content of vitamin A as indicated by the vitamin-A-scope.

Concurrently with the administration of 10 human units in such cases there is usually a marked uplift in physical well being and energy available for work and activity of the brain, glands and other important tissues and organs.

To clinch the truth of the seeming miracle about the changing of hair back to normal, after oleum carchari in .5 cc. doses, each containing 10 human units of vitamin A, was given for a year hairs from the body were seen to be white in their outer half while the proximal half had been growing in with the natural color.

While I was on the staff of the Mayo Clinic it was possible to make many valuable observations through the examination at one time of one hundred cases of cancer or their records and the subsequent notation of the physical characteristics. One characteristic was the tendency in this group to have what is commonly called "liver spots", pale brown squamus patches slightly resembling moles, on the side of the forehead or hands. Strangely enough, they occur where the skin is exposed to the vitamin D rays of the sun.

By making a thousand tests on the vitamin-A-scope it was observed that this same type of person with "liver spots" and other signs usually attributed simply to old age, showed marked vitamin A deficiency. Therefore this observation, together with others, definitely proved the fact that the cancer type human is more deficient in vitamin A than the cancer resistant individual.

Vitaminascopic tests having revealed this, such a condition has been followed by abatement of "liver spots" after the subject has

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The Electron Microscope

RUTH E. DYNES, E.E. '42

It is indeed with regret that Th' Cornell Engineer announces the resignation of Miss Dynes, a former member of the Junior Editorial Board, who recently transferred to Stanford University. Ambitious and conscientious, she had written two previous contributions for this magazine, one on "Frequency Modulation", the other on "Early Gliding at Cornell", both of which were published last year.

The Cornell Engineer wishes to extend to this authoress best wishes for success in her new Alma Mater and later in the engineering field.

TELEVISION, in a single decade, has been almost solely responsible for the growth of the new field of physics known as electron optics. In turn, this branch of research has resulted in the development of the electron microscope . . . which, and it is ultimately possible, will reveal the details of atoms.

The limit of the detail that an ordinary optical microscope, using visible light, can detect is determined by the resolving power of the microscope, its ability to show two lines as separate and distinct. The smallest-sized object which can be seen through any microscope is roughly one-half of the wave-length of light employed. The range of visible light is approximately from 3900 to 4600 Angstroms (10^{-8} cm. =1 Angstrom); consequently the limit is an object about 2000 A. long. The simplest method of improving the resolving power is to use shorter wave-lengths. For instance, with ultra-violet light a resolution of 1000 A. can be obtained. Electrons, however, surpass this performance.

Prince de Broglie, the French physicist, in 1927, issued a statement in connection with his studies of wave-mechanics, that electrons, generally thought of as being particles, possessed wave-like characteristics and hence could be thought of as another form of those electro-magnetic waves which include visible light. Three years later this hypothesis was verified. It was found that the exact wave-length was variable and dependent upon the velocity of the electron. The higher the speed of the electron, the shorter the wave-length associated with it.

Construction of an electron microscope was first undertaken in Germany in 1931 by the famous experimenters Knoll and Ruska and all significant study of the subject — by Dr. Ing. von Borries, Bruche and Johannson, took place there until 1937, when the English built one at the Imperial College, London, of which Prof. L. C. Martin was the chief designer. About the same time Dr. Vladimir K. Zworykin, Director of Electronic Research at the RCA Laboratories, turned from television to the subject of seeing with electrons, and a model was completed last year in co-operation with other RCA scientists. An advanced instrument has just been built at the University of Toronto by Drs. E. F. Burton, J. Hillier, and A. Prebus, which has exceeded previous magnifications obtained by this method.

The principles involved are simple and are conveniently susceptible to the use of an optical analogy. A cathode ray tube is the source of electrons, corresponding to the illumination in an ordinary optical instrument. The concentrated ray of beams passes through a circular hole in the anode plate, and past a beam-trap which is employed like a shutter to protect delicate specimens from disintegration when not under observation. The specimen-holder is directly below the trap. The nearer it is placed to the anode, the higher the possible magnification.

Magnetic or electrostatic fields, or combinations of the two, act as electron lenses which control the stream and bring it to a focus at the first image plane. The image can be directly viewed by placing a fluorescent screen in this plane where the energy of the electronic stream is converted into the energy of visible radiation. Photographs may also be taken in this plane. In the Imperial College Instrument an optical microscope is incorporated in the frame, its axis parallel to that of the larger microscope, by this means comparisons of magnification are possible. The object can be swung into the object plane of either instrument at will.

Parts of the image may be selected for further magnification, which may be obtained by passing the beam through a second lens and projecting it on a final plane, where, again, it may be viewed directly or photographed. The frequency of radiation of the tube screen, which gives a green light, occurs in the range of maximum sensitivity of the eye.

The University of Toronto microscope has obtained a final magnification of 12,700 times at the screen, and this image has been photographically enlarged up to 180,000 diameters. The finest detail has been 60 A. The tremendous advantage of the new method is evident when one considers that the highest magnification obtainable with an optical super-microscope is only 5000 times. Dr. Zworykin has predicted that objects as small as 10 A. in length may ultimately be seen.

The electron microscope has drawbacks which limit its practicability for wide use and prevent it

from attaining theoretical limits. In the first place, it must be protected against mechanical vibration. The supply voltage which may run as high as 100 kv. must be well-filtered; ripples in the voltage will distort the electron lenses as will variations of current in the coils. A high vacuum must be maintained within the tube to prevent gas molecules from scattering the electron stream. The specimen being placed within the tube itself, it is necessary to rotate the object-holder into an air-lock when changing specimens, take out the old object, replace it by a new one, evacuate the lock, and rotate the holder back into position. Through experiment the time consumed in this process has been reduced to five minutes. A high quality of construction is required throughout.

Biological specimens which it is desired to observe may be destroyed by heat or electron bombardment. A lack of symmetry in the electrostatic or magnetic field about the axis of the tube will cause defects of the electron optical system comparable to spherical aberration; this may occur even when the controls are correctly aligned mechanically . Variations in the speeds of individual electrons cause the equivalent of chromatic aberration in ordinary optical systems. These effects are minimized when the electron beam remains reasonably parallel to, and close to, the longitudinal axis of the microscope. Even the effect of the earth's magnetic field on the high-speed particles must be compensated for by the use of Helmholtz coils, to prevent undesired deflections of the beam. Finally, the RCA model costs over $17,000, requires technical operators, and is over six feet in height.

These considerations will prevent extensive use of the microscope commercially in the near future, but it opens new fields of research in medicine and industry. The radio engineers have been able to study the most important phenomenon of the vacuum tube — the exact nature of the action of thorium on thoriated-tungsten cathode filaments. Similarly a study has been made of oxidized and pure metal cathodes. It has been shown as a result, that in some cases the surfaces are originally crystalline, but become molten and finally recrystallize as the temperature is steadily raised. The electron emission is not constant over the surface; the regions of highest emission are seen as the brightest areas of the image.

The crystal structure of thin metal foils has been examined. A photograph of the edge of a new razor-blade presented a rather disturbing picture. Viewing the image purely from the scientific angle, however, it showed a remarkable freedom from diffraction effects which was attributable to the ultra-short wavelengths employed. At this point, it may be appropriate to discuss a point which may have occurred to the reader. Why not use even shorter waves for illumination, those in the range of x-rays? The answer is that means have not yet been found to control them.

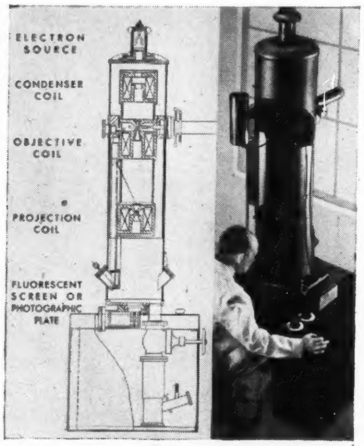
Biologists and bacteriologists have already observed viruses about which they had only indirect knowledge before. Viruses are large particles, of the size of complex molecules, which display semi-animate, semi-inanimate characteristics and are responsible for a number of common diseases. It is hoped that heredity-transmitting genes, and bacteriophages, germ-killing bacteria, may also be studied. It is not necessary to stain specimens, as when visible light is used.

This instrument is yet another justification for the support of pure scientific research. Having

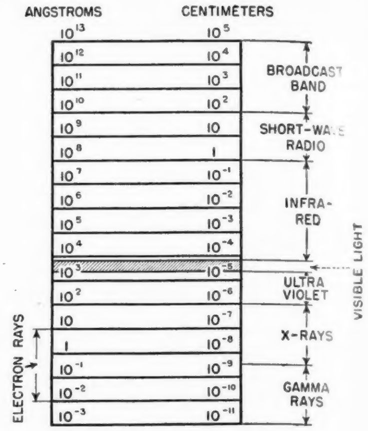
(*Continued on page 23*)

This latest electron microscope achieves a magnification of 25,000 to 30,000 instead of 5,000 maximum with even ultra-violet light. Seated looking at the instrument is Dr. Ross Harrison, Yale University. Standing are Dr. Ladislaus Marton, left, who with Dr. V. K. Zworykin, RCA Research Laboratories, developed the microscope and (center) Dr. A. V. Hill of Cambridge, England.

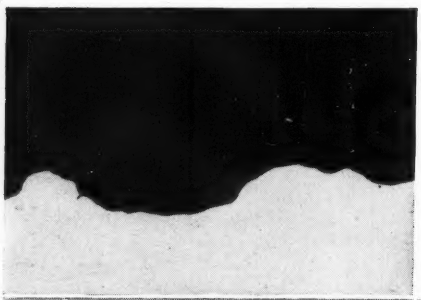
—Courtesy Science News Letter



Electron microscope at RCA Laboratories.



Comparison of wavelengths of the family of electro-magnetic waves and of electron rays.



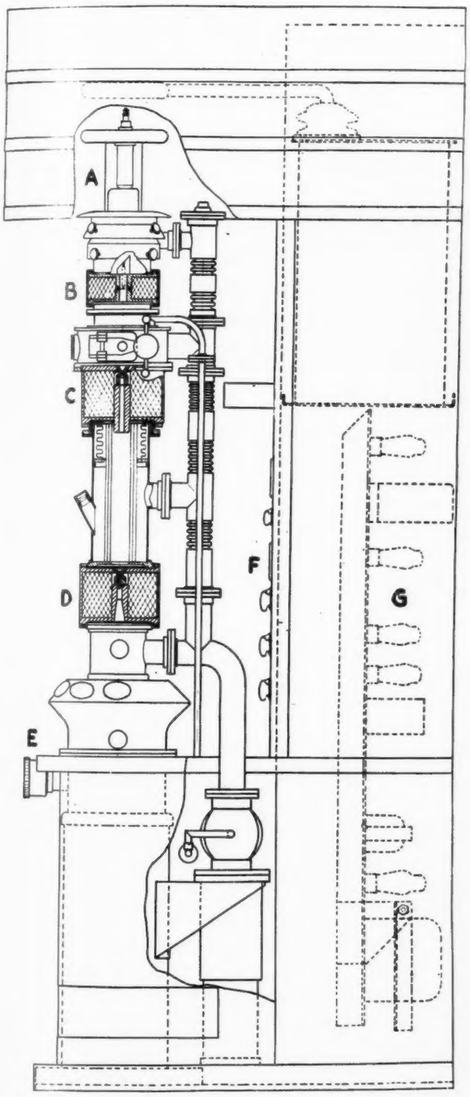
Edge of a new razor blade. 24,000 times. U. of Toronto.

Carbon grains of lampblack used in making printer's ink magnified 100,000 diameters. One of the best electron microscope photomicrographs ever made.

A diphtheroid bacillus, by Hillier. 35,000 times.

—Cuts Courtesy Scientific American

In Functional Drawing Below of Electron Microscope Pictured at Right, A is the Electron Source, B is Magnetic Condenser, C is Magnetic Objective, D is Intermediate Image Projector, and E is the Second Stage of Magnified Image.



Electron Microscope Constructed at RCA Laboratories. A Diagramatic Comparison Picture Appears at the left.

Both Cuts Courtesy RCA.

CORNELL SOCIETY *of* ENGINEERS

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

President's Message

Fellow Engineers:

Following the policy which I mentioned in the last issue of The Cornell Engineer, it is my hope that we may be able to give you some interesting news of Society activities.

First, let me introduce the complete Executive Committee of the Cornell Society of Engineers.

In addition to the officers listed at the head of the page, and the chairmen of the five standing committees reported upon in the last issue, they are as follows:

	Term Expires
Past Presidents	
Willis H. Carrier '01	May, 1943
Walker L. Cisler '22	May, 1942
Gustav J. Requardt '09	May, 1941
College Representatives	
Chemical Engineering	
Director F. H. Rhodes '14	May, 1941
Burton J. Lemon '08	May, 1941
Civil Engineering	
L. B. Waterbury '19	May, 1942
B. L. Wood '11	May, 1942
Electrical Engineering	
Geo. N. Brown '08	May, 1942
E. C. M. Stahl '13	May, 1941
Mechanical Engineering	
N. G. Reinicker '11	May, 1941
M. B. Tuttle '19	May, 1942
N. Y. Representative	
Regional Sections Committee	
J. H. Lawrence '09	May, 1941

The Executive Committee held its first meeting at the Cornell Club of New York on September 24, 1940, when a program for the coming year was outlined and reports from the members of the standing committees were received.

The next meeting of the Executive Committee was held at 5:30 o'clock, prior to a meeting of the New York group, on Wednesday evening, October 16, 1940.

Rear Admiral Yates Stirling U.S.N. (Retired) addressed a large group of Cornell engineers and their guests, following a dinner held on that date at the Cornell Club of New York.

Rear Admiral Stirling presented his viewpoint on the present position of Great Britain and the possible future position of the United States, with special reference to the particular parts which the British and American fleets would play.

Word is received of the first meeting of the season of the Philadelphia regional group, to be held Wednesday noon, October 23rd, in the Engineers Club auditorium in Philadelphia. Dean Hollister was scheduled to talk on "Plans of the College of Engineering". This article is going to press before we can make a final report on what promises to be a very interesting meeting for the Philadelphia group.

The New York group plans a Cornell Engineers' Home-Coming Evening early in December at the time that the American Society of Mechanical Engineers convenes in New York. Dean Hollister, the Directors of the Schools of Engineering, and members of the faculty will be invited to attend. No formal speeches are planned but it is hoped that there will be much interesting friendly round-table discussion between alumni and faculty.

All members who are employers and need men are reminded to get in touch with the Cornell University Placement Bureau. The New York City work is ably carried on by Paul O. Reyneau '13 at the Cornell Club of New York, 107 East 48th Street. Paul is also our hard working and efficient Secretary and Treasurer. He has just completed new arrangements and procedure for handling CORNELL ENGINEER mailings to Society members, which we hope will prevent delays and omissions.

A telegram from Henry B. Brewster, Vice President of the Syracuse region, says that they are today (October 15th) holding a joint meeting with the Optimist Club, at which Dexter S. Kimball, Dean Emeritus, is the guest speaker.

The Society is in a good position financially and has a fine nucleus of members among Cornell Engineering Alumni. It should be the duty of every Cornell Engineer to become a member of this Society. The dues are reasonable ($2.00 annually, including a subscription to THE CORNELL ENGINEER). I ask you to help the Membership Committee by getting your Cornell en-

(*Continued on page* 24)

AMONG YOU

Dr. Arthur S. Adams

THE CORNELL ENGINEER takes great pride in presenting Dr. Arthur S. Adams, Assistant to the Dean of the College of Engineering.

It was during the war year 1918 that Midshipman Adams received his diploma and commission as ensign from the United States Naval Academy. Since the navy needed qualified men for the submarine service, Ensign Adams was shipped out to the New London submarine school, where he was instructed in submarine operation. Upon completion of this graduate schooling, Ensign Adams became executive officer of the R-16, a submarine which was detailed to the Panama Canal Zone for the duration of the war.

World War I was soon over and the R-16 headed for the west coast, only to be given orders to go to Hawaii. After a pleasant stay in these tropical waters, the R-16 returned home and lost its executive officer to the F-2, another submarine. Executive Officer Adams was promoted to the position of commander of the F-2. Following a year of service with sub F-2, the navy transferred Commander Adams to the U.S.S. Arkansas, on which he served as a division officer for the engineers. Those were the days when America was demonstrating to its Pan-American neighbors how fortunate they were in having the United States as a friend, and so the U.S.S. Arkansas sailed down to Chile.

It was in 1921 that a critical metamorphosis entered Dr. Adams' life. Three years of active service, most of it within the close confines of a submarine, finally extracted its toll from the seaman. The man, broken in health but not in spirit, spent ten months in the Colorado naval hospital convalescing from tuberculosis. Realizing that his navy days were over, the former naval officer filled the void in his life by turning to pedagogy, starting with teaching in the public schools of Denver and progressing into the organizing of a private school with himself as Associate Principal. But this was not enough —there was more to be learned. And so the teacher again became a student, this time at the University of California. From this institution he received his Master's degree.

Things went rapidly now. In 1926 student Adams returned to Colorado for schooling at the Colorado School of Mines. As Dr. Adams, he remained at the School of Mines to become eventually Professor of Mechanics, Assistant to the President, and Adviser to the Freshmen. With the exception of the summer of 1929, Dr. Adams has been with the Colorado School of Mines until this year. He served the summer of '29 as visiting professor at his former school, California.

Dr. Adams likes Cornell. He likes the pride Cornellians take in their school; he likes the democratic atmosphere of the campus; and he is impressed by the closeness of Cornell's College of Engineering with industry. He hopes to be here for a long time.

Although the proverbial sailor has a sweetheart in every port, this did not apply to sailor Adams. It was soon after graduation from Annapolis that he was married. His son, who is finishing his senior year in Solbury School in New Hope, Pennsylvania, hopes to become a Cornellian. Dr. Adams is a Sigma Nu from the Colorado School of Mines.

"The Development of Physical Thought", a textbook in physics, was written by Dr. Adams in collaboration with Professor Leonard B. Loeb of the University of California. Plans are now in order for publishing of a paper on thermodynamics.

Raymond W. Kruse '41 A.E.

A Cornell engineer, the son of a Cornell engineer, is Ray Kruse, '41. Claiming the distinction of being one of the few administrative engineers in E.E., Ray has added to this not a few outstanding honors and distinctions on the Hill, for who is the Cornellian not acquainted with "Krause" through the Musical Clubs and the Savage Club? Starting in his Freshman year, he was a member of the Freshman Banquet Committee; he added one more the next year by serving on the Sophomore Smoker Committee, and has been adding up services ever since.

Ray will be remembered as the leader of the Glee Club, as well as a member of the famous quartet of the Class of '41 which performed so well in the Musical Club's show "In The Red." In his Junior year he was elected to Red Key, Eta Kappa Nu (electrical engineering honorary), Kappa Tau Chi (administrative engineering honorary); he served on the executive committee of Cornell Day, and as chairman of the Willard Straight Music Committee, and of the Junior Prom Committee. His most recent honor was his election to Quill and Dagger, subsequently followed by an election to the presidency of that body.

"Krause" entered Cornell from Radnor High School, Radnor, Pennsylvania, and on his record maintained a McMullen Regional Scholarship for six terms. In his fraternity, Kappa Sigma, Ray has served as Rushing Chairman, and

(*Continued on page* 23)

ENGINEERS

Richard G. Davis '41 C.E.

Seven generations of northern Vermont heritage have failed to effect a pronounced change in the quiet, friendly, deliberate attitude that was a part of the first progressive settlers of this country—at least whenever Dick Davis is considered a criterion. Although now residing in Washington, D. C., his true home surroundings of Vermont have stamped him with the Yankee tradition of ambition, initiative, and accomplishment of whatever he sets out to do.

Midway in this change from Vermont to Washington, both geographically and chronologically, was the period he lived in Ithaca, where his father was Major of Ordnance in the R.O.T.C. post here, and from which Dick entered the school of Civil Engineering as a freshman. Taking things easy the embryonic colossus found his way into the Freshman Crew, rowing position seven, into Pershing Rifles, A.S.C.E., Beta Theta Pi, and a few minor activities. He continued his outdoor exercise that summer, putting his inherent civil engineering ability to work in building a cottage for the family on a lake in northern Vermont. It was a tremendous amount of fun, and conditioned Dick for the Jayvee Crew his sophomore year, now in the bow. Crew Club was a natural result of his work on the water, but in addition he was now a full-fledged member of the Dean's List, a position which he has not relinquished. As a direct result of the latter, Dick was awarded a McMullen Regional Scholarship when his family moved to Washington and he became an out-of-state resident.

Tapped by Pyramid that spring, he forgot school long enough to attend the Ordnance Camp at Aberdeen Proving Grounds that summer, but resumed scholastic pursuits five weeks early at the Civil Engineering Summer Surveying Camp.

With the advent of the Junior year, honors flew thick and fast. Joining the Officers' Club, he was later on in the year elected President. Red Key, Chi Epsilon, Tau Beta Pi, Sphinx Head, Freshman Advisory Committee, Junior Jamboree Committee, Scabbord and Blade, and Varsity Crew as bow man were all mutual aids and stepping stones into the limelight of prominence. In addition, a very promising and capable young man was brought into the ranks of the Student Council during the spring elections. Presidency of both Pyramid and Chi Epsilon came on the same night that spring, and brought to an end a year of successful campus activity.

As assistant engineer doing estimating and designing in the main office of Dravo Corporation in Pittsburg, Dick picked up many valuable pointers the summer of his Junior year.

This year, of course, all his activities are continued, with added positions of responsibility contributing to a most varied program.

When Dick first came to Cornell, he had full intentions of transferring to the Military Academy at West Point after his sophomore year. He even went so far as to pass all his examinations and to receive his orders to report, when he changed his mind because of his attachment to cosmopolitan Cornell. Naturally, rowing has been his principal enjoyment here, especially in the fall, when the foliage fringing Cayuga, combined with gorgeous sunsets over the quiet water, presents a picture difficult to describe.

The "cradle" of his class, Dick Davis was only twenty on October 27th, but even at this age, as you can see, he has made both a brilliant and enviable record, worthy of an excellent position in construction or production, the fields he hopes to be in after graduation.

John C. Antrim '41 A.E.

Wendell Willkie and Jack Antrim have two things in common: both come from the Middlewest and both are good politicians. Evidence of Jack's political ability can be found in many past issues of the *Sun,* the shingles that adorn his room, and from his many friends. Now serving as Student Council Prexy and Frosh Basketball Manager, politico Antrim looks back over three years of activity and finds that he has served on nine committees, has been on the Student Council for three years (this year is his third), was elected to three honor societies, Red Key, Kappa Tau Chi, and Quill and Dagger; even more, Jack's name appeared on the Honor List. He is the engineers' BMOH.

True to Cornellian tradition, Jack spent the summer between Sophomore Mechanics and Junior Mech Lab in a factory. The particular factory he worked in is now one of vital importance to the nation's defense program. Jack worked in the jig fixture and experimental tool department of Douglas Aircraft in Santa Monica, California. Although the shift from 5 p. m. to 1.30 a. m. sounds least desirable, Jack claims that it was really the best one, because he had from ten in the morning until late afternoon to spend in California's famed sunshine.

Being in the Ordnance division of the R.O.T.C., Jack spent the past summer at Aberdeen, Maryland, home of the Army's Ordnance Training Camp.

After graduating from Cornell,

(*Continued on page* 23)

News of the Engineering Alumni

Dr. Oliver E. Buckley, who received his Ph.D. in 1914 from Cornell University, was recently elected president of the Bell Telephone Laboratories, Inc., the research and development organization of the American Telephone and Telegraph Company.

After receiving his degree in 1914, Buckley joined the Western Electric Company as research physicist and since that time has been intimately associated with telephone research. In 1925 he advanced to assistant director of research, for the Bell Telephone Laboratories; he was made director in 1933 and in 1936 became executive vice-president, which position he held until his recent appointment.

Buckley is a member of the Engineering College Council of Cornell University and also chairman of the Engineering Foundation, the research organization of the four national societies of civil, mechanical, mining and metallurgical, and electrical engineers. He is a member of the National Academy of Science and a fellow of several technical and engineering societies. Buckley is also a major in the Reserve Signal Corps of the Army.

Dr. Buckley is best known in the engineering world for his work on high-speed submarine telegraph cables, ionization manometers, and telephone transmission lines.

Willis H. Carrier, M.E. '01, chairman of the Carrier Corporation of Syracuse, is the author of an article entitled "The Employer Looks at Needed Improvement in Our System of Technical Education", which appeared in the October issue of "Mechanical Engineering."

Mr. Carrier is generally recognized as the founder of modern air conditioning and was designated last year as one of the outstanding pioneers of American industry. He has been awarded the Anderson gold medal of the American Society of Mechanical Engineers, and is a fellow of the Royal Society of Arts and past president of the American Association of Heating and Ventilation Engineers. He is also a member of the Board of Trustees of Cornell University; last year he was president of the Cornell Society of Engineers.

After graduating from Cornell, he spent 13 years with the Buffalo Forge Company, and then in 1915 founded his own company to manufacture air-conditioning equipment. His research, much of which has been done in cooperation with the engineering staff at Cornell, has made him the foremost engineer in this field.

W. L. Havens, C.E. '16, is a partner in the firm of Havens and Emerson, consulting engineers of Cleveland. This firm was organized in August following the death of Mr. Gascoigne; it succeeds Gascoigne and Associates, with which Havens was affiliated for seventeen years.

The firm specializes in water supply and sewerage and waste disposal, and has been employed for many years on important projects by the City of Cleveland. Havens was employed by the City of Cleveland for seven years immediately following his graduation, and then joined the Gascoigne organization, in which he later became a partner.

Clarence H. Davidson, C.E. '11, was in Ithaca during the last two weeks of September for conferences with Dean S. C. Hollister of the College of Engineering. Davidson is chairman of the committee on publications of the Cornell Society of Engineers.

Norman H. Tilley, M.E. '15, was recently named chief engineer of the Lawrence Engineering and Research Corporation, Linden, New Jersey.

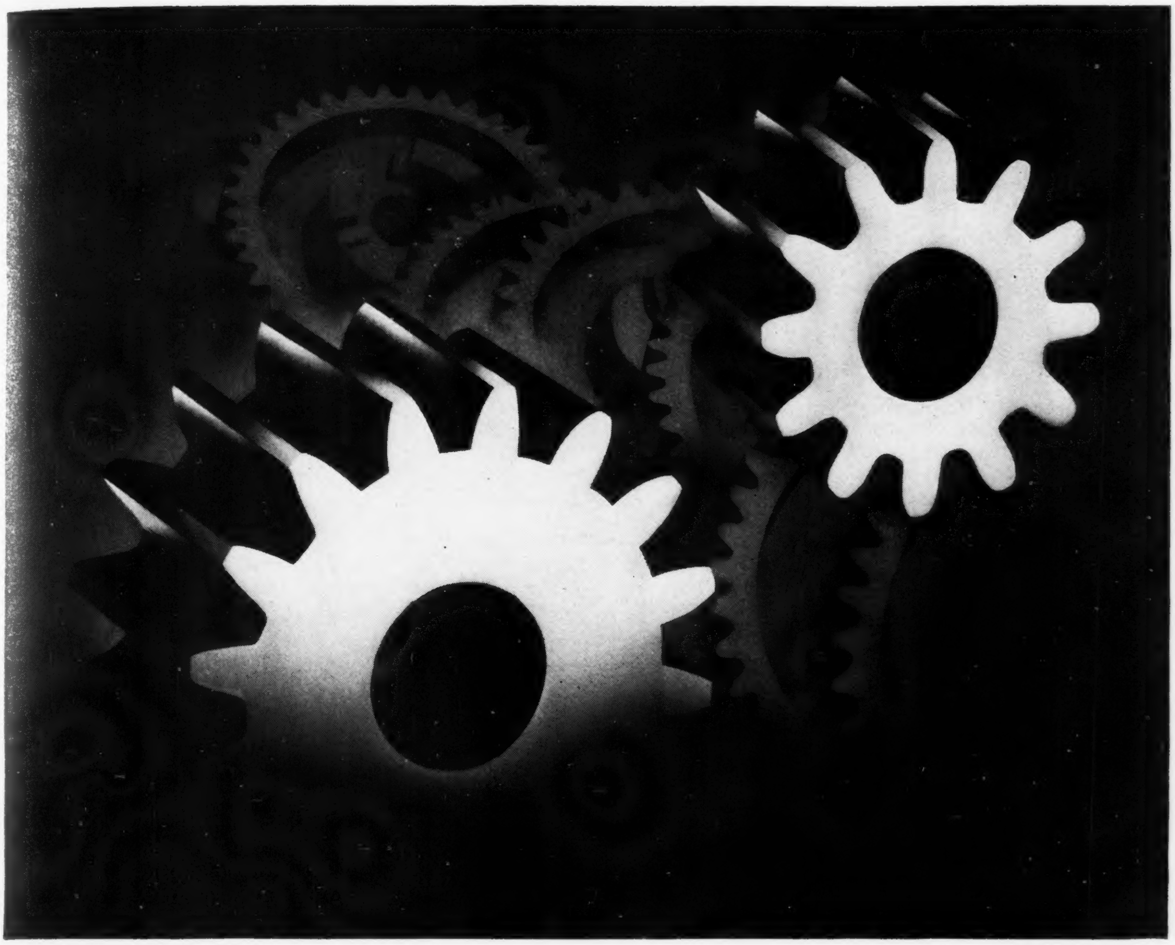
After receiving his M.E. degree, Tilley remained at Cornell until 1918, first as an instructor in experimental mechanical engineering, and later as Army Air Service instructor on aviation engines. He stayed in the Air Service until 1920 as flying cadet and later as airplane pilot and engineer officer in charge of various training courses at Kelly Field.

During the next two years he taught mechanical engineering at the New Mexico A. and M. College and at the University of Texas. In 1922 he joined the Engineering Division of the Air Service and became the chief engineer of the Kinner Airplane and Motor Corporation; he continued to serve in that capacity until 1931, when he was placed in charge of engineering for the American Airplane and Engine Corporation engine department. In 1932 he joined the engineering department of the Continental Motor Company and later joined the Lycoming Division of the Aviation Manufacturing Corporation, where he has been until his recent appointment.

Tilley is also vice-president of the Society of Automotive Engineers, in charge of aircraft-engine engineering activity.

Alexander W. Dann, C.E. '07, executive vice-president of the Dravo Corporation, is the author of an article entitled "Modern Developments in Towboats and Barges for Inland Waterways" which appeared in the October issue of "Civil Engineering".

He is president of the Keystone Sand and Supply Company and is a member of the Engineering College Council at Cornell.



News of the Engineering College

Once again news of the proposed new buildings for the College of Engineering is circulating throughout the campus. The reason for this sudden flurry of excitement can be found in Sibley Dome where another new model of the proposed buildings is now on display.

Working under new instructions from the Board of Trustees, the University architects Shreve, Lamb, and Harmon, recently have completed this model of the proposed building development for the College of Engineering. It is now planned that the College in the future shall occupy space at the south end of the campus bordered by Central Avenue on the west, Hoy Field on the east, Cascadilla Creek on the south, and Barnes Hall on the north. On this larger site it is possible to erect a group of structures with all the needed floor space—approximately three times that of the present engineering buildings—and yet without any unusual height or crowding.

Most of the proposed buildings can be erected without disturbing any existing buildings, although eventually the Old Armory and Sage College as well as several frame structures may be removed. The present plan also provides for preserving the Sibley Buildings, Franklin, Rand, and Lincoln Halls, which can be remodelled for the use of other divisions of the University.

The plan has been developed on a functional basis so that units of the college will be effectively related. The Materials and Metallurgy Laboratory, which extends along the edge of the gorge, will house laboratories and shops used especially by mechanical and civil engineers whose buildings will be directly adjacent. The Lab will be used also by chemical and electrical engineers, who will be only a short distance away. The administration offices of the college will occupy a portion of the Civil Engineering building close to the center of the entire group.

Efforts will be made to secure financial support for the early construction of the Chemical Engineering building and the Materials and Metallurgy Laboratory. These are the two most seriously needed at this time.

Tau Beta Pi

CLASS OF 1941

Albert Davis Bosson M.E.
Shurly Russell Irish, Jr. M.E.
Kenneth Adelbert Kesselring E.E.
Charles Wm. Lake, Jr. A.E.M.E.
Jean Paul Leinroth, Jr. M.E.
Robert Cleland Ross A.E.M.E.
John Carman Sterling, Jr. M.E.
Walter Burns Shaw C.E.

CLASS OF 1942

John Rodgers Dingle A.E.M.E.
John Walter Kruse Arch.

While plans for the College of Engineering buildings move forward, improvements have been made in several of the present buildings. Perhaps the most noticeable of these improvements are those which have been made to the Electrical Engineering Lab. in the basement of Franklin Hall. Credit for the development and adoption of the present system goes to Professor Burckmeyer and Mr. Bristol of the E.E. School. Last December they started to provide for a more flexible set-up which would include such desirable features as portability, increased efficiency, interchangeability, and facility of maintenance.

The first step consisted of laying a new concrete floor to replace the old one which was in a poor state of repair. With a new foundation on which to work, they next turned to the problem of noise that issued from the motor generator sets, used to convert ordinary alternating current into direct current required for laboratory work. This problem was solved by erecting a sound-proof partition between the machines and the rest of the room. This partition serves a dual purpose as it is also used as a mount for a master control panel and d-c meters.

New bench and engine set-ups were designed to permit an entire group of students to see clearly each individual piece of apparatus used in the experiments. The apparatus, in turn, has been made easily portable, with the distinct advantage that each element when not in use, can be employed at any station in the lab.

Other improvements include the addition of four motor-generator sets, the installation of a new rigid conduit-terminal block, the conversion of a useless corridor into a convenient storage closet, and the rearrangement of faculty offices. Even the battery charger which puts new life into many of the cars on the hill shared in these changes when it was given a new copper oxide rectifier in order to eliminate any possible danger incurred in charging batteries on rainy days.

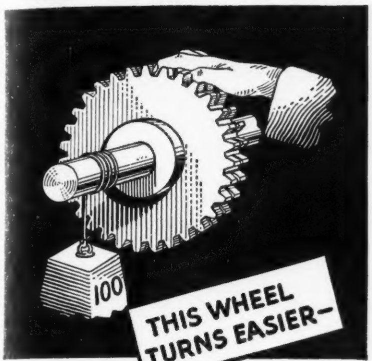
These improvements have been made with only limited expenditures.

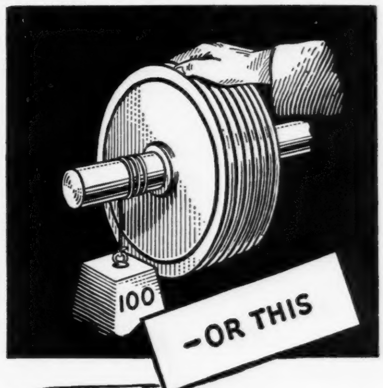
Appointments of an assistant professor and a Westinghouse Research associate in the School of Civil Engineering, and seven instructors in the Sibley School of Mechanical Engineering were announced on October 12 by Dean S. C. Hollister.

George R. McCaulley, formerly assistant professor of structural design in Kansas State College, has been made assistant professor of mechanics of engineering in the School of Civil Engineering. He holds the B. S. and M.S. degrees in architectural engineering from M.I.T., has had a year of experience with the American Steel Derrick Co. as structural engineer, and two years in the same capacity with the Eastman Kodak Co.

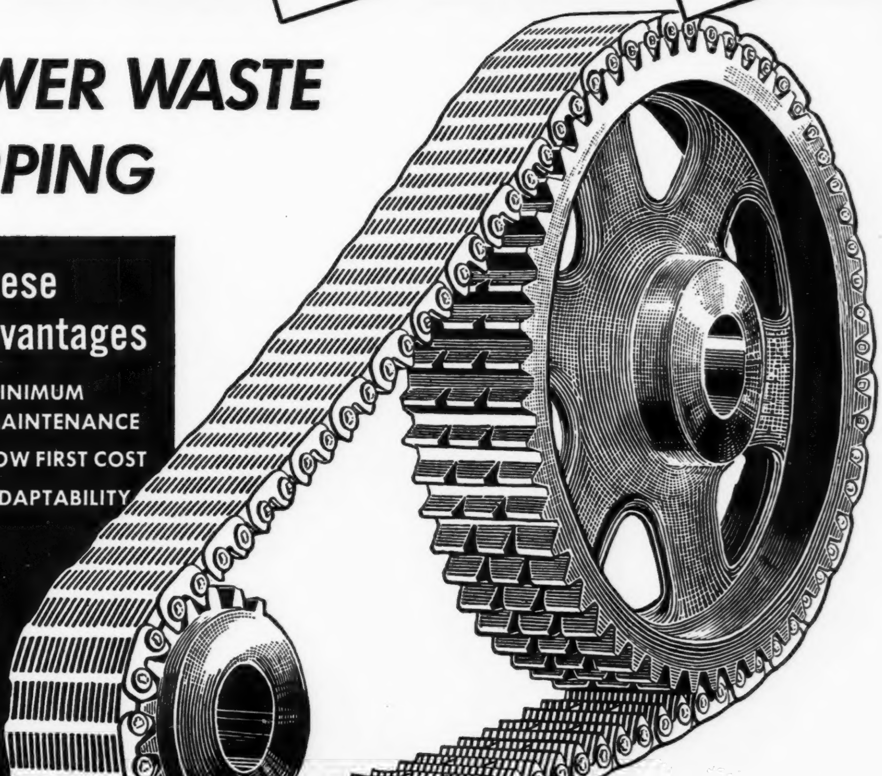
The newly appointed Westinghouse research associate is Dr. Henri S. Sack. He was formerly an assistant to Dr. Peter Debye, of the Cornell Department of Chemistry, at the University of Brussels, and he is a recognized authority on supersonics.

Teeth Not Tension





NO POWER WASTE
NO SLIPPING



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MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

Steam Plant . . .

(*Continued from page* 8)

Motor drives for nearly all other auxiliary equipment predominate in present-day power plants. It is essential, however, that the source of this energy be such that it will not be subject to electrical-system disturbances but will be reliable and function under all operating conditions. Alternating current is almost universally used, although one or two large generating systems in this country use a direct-current auxiliary system because of the advantage it affords in simplicity, safety to maintenance and operating attendants, and the adjustable-speed feature obtainable with direct-current motors. The primary source of this direct-current energy may be either from motor-generator sets which in turn obtain their supply from the electrical system, or from steam-turbine-driven direct-current generators. This latter method is of course the more reliable since it will be unaffected during an electrical-system disturbance.

Alternating current for auxiliary service can likewise be obtained directly from the electric system through transformers or from separate steam-driven turbo-alternators or from auxiliary generators driven from an extension of the shaft of the main turbo-generators.

All of the methods of auxiliary-energy supply mentioned are in service in large Central Stations, and the designer of a new plant must weigh the advantages of each in making a selection. Usually the alternating-current method where the source of energy is obtained from the electrical system will be found to require less investment than the others. However, a large generating plant represents a great investment and its auxiliary system, above all, should have a high degree of reliability; so it would be false economy to make the selection purely on the basis of cost.

The feedwater heating system is designed around the extraction heaters which take steam extracted from several stages of the main turbine. In order to determine the most economical number and arrangement of heaters and the selection of stages from which to extract steam, a series of cases must be considered and the cost of equipment of each balanced against the thermal gain. This feedwater heating system usually includes an evaporator for use in supplying pure condensate as make-up for the steam and water lost from the circuit during normal operation.

In plants employing high steam pressure (say 600 psi and above), it is of the utmost importance that the water fed to the boilers be free of dissolved oxygen, so deaerators or methods of deaerating the condensate and make-up water must be provided. Such equipment usually becomes a part of the feedwater heating system.

The general appearance and the operating convenience of a power station are greatly influenced by the piping arrangement. A method often found useful to designers in selecting the location for all the various kinds of piping is the use of small-scale models wherein the equipment is located in its correct position and the piping runs can be made with wire or extruded wax. By this means a symmetrical and properly-spaced arrangement is obtained in which interferences are avoided at the time of the design.

In the case of the high-pressure and temperature steam and water pipes, valves and fittings, the designer must make his selection from certain dimensional and material standards. Great progress has been made by the metallurgists during the past few years in producing commercially the materials required for high-temperature service.

Space permits merely the mention of the most important auxiliaries such as condensers, heaters, pumps, forced- and induced-draft fans, stokers, pulverized-fuel mills with their burners, and generator air coolers. The capacity and operating conditions of each one in its turn must be considered in order to arrive at the most economical size and type to be installed.

The completed plant should reflect an orderliness of design in which the vast number of components are so coordinated that during its subsequent years of service the operating force will be cognizant of the advantages resulting from a well-thought-out and engineered design. In such a plant, a high degree of efficiency may be expected.

College News . . .

(*Continued from page* 20)

Thirty-one students now enrolled in the College of Engineering have been granted John McMullen Regional Scholarships, Dean S. C. Hollister announced recently. New scholarships have been made available by a recent action of the Board of Trustees, allocating part of the increased revenue from the John McMullen Fund for this purpose. Recipients of these awards may hold them during their entire college courses, providing that they maintain high scholastic standards.

Those receiving the scholarships are Robert Downing Chaffe, Ch.E. '44 of Paoli, Pa.; John Maurice Crom, Jr., Ch.E. '41 of Jackson Heights, N .Y.; Ralph Seymour Ludington, Ch.E. '41 of Holley, N. Y.; William Newby Freeman, C.E. '41 of Ithaca, N. Y.; Howard Poyer Lynch, C.E. '41 of Brooklyn, N. Y.; John Thompson Riday, III A.E.-E.E. '41 of Germantown, Pa.; William Charles Don, E.E. '41 of St. Johnsville, N. Y.; William Robert Percy, Ch.E. '42 of Inwood, N. Y.; James Markel Snyder, Ch.E. '42 of Croton-on-Hudson, N. Y.; John Frederick Mattern, C.E. '42 of Thompsonville, N. Y.; Mateo Lian Poa Go, C.E. '42 of Cebu, Philippines; Albert Brodzinsky, E. E. '42 of Buffalo, N. Y.; James William Cochrane, E.E. '42 of Augusta, Ga.; Harry Jeannot Lipkin, E.E. '42 of Rochester, N. Y.; Corles Melvin Perkins, E.E. '42 of Milwaukee, Wis.; Michael Charles Pastorelle, Ch.E. '43 of Ithaca, N. Y.; Richard Harwood Morgan, Ch.E. '43 of Beaver Dams, N. Y.; John Irving Holdern, C.E. '43 of Southampton, N. Y.; Stephen Douglas Teetor, C.E. '43 of Poultney, Vt.; Robert Earle Hutton, E.E. '43 of Canandaigua, N. Y.; Angelo Margaris, E.E. '43 of New York City; Charles Glenn Morrison, E.E. '43 of Verona, N. J.; Dean Bussman Wheeler, E.E. '43 of Hancock, N. Y.; Louis Gaston Helmick, Jr. M.E. '43 of Fairmont, W. Va.; Robert William Perry, Jr., M.E. '43 of Niagara Falls, N. Y.; Anthony Misciagna, C.E. '44 of Altoona, Pa.; Walter Lee Taylor, C.E. '44 of Rumford, R. I.; Henry John O'Hara, Ch.E. '45 of Syracuse, N. Y.; Berton E. Ely, Ch.E. '45 of Florham Park, N. J.; Moody Chalmers Thompson, Ch.E. '44 of Los Angeles, Cal.; Robert Gordon Christie, C.E. '44.

Vitamin A . . .

(*Continued from page* 9)

taken an amount of a natural vitamin A as indicated by test on this instrument.

In conclusion it might be stated that a person's tendency to cancer is in inverse ratio to his supply of natural vitamin A.

Illustrated is a recent standard type of vitamin-A-scope, consisting simply of a view box, a source of glare, and a means of replacing the glare with a discernable letter on a black background. The subject simply gazes at a circle of light (in a room with subdued illumination) for 20 seconds, when a bakelite card with one of two letters showing, either a Gothic L or T having equal areas of whiteness, is introduced and shoved down to cut off the glare and substitute that letter which is lighted by a per cent of the original light which is located in the square box shown. The process is about as quick and simple as taking a snap shot.

Microscope . . .

(*Continued from page* 11)

its origin in a principle of wave-mechanics and embodying the result of fifteen year's research in the seemingly abstract sphere of electron optics, it has been brought by the engineers of such giant electrical companies as Siemens and Halske A. G. in Berlin, Metropolitan-Vickers in London, and the Radio Corporation of America, acting as liaison-officers between theoretical and applied science, to the point where it may greatly improve the health of the public, as well as the performance of articles of everyday use.

Message . . .

(*Continued from page* 14)

gineering friends and business associates to join today.

New regional groups should be organized in order to make the Society more active in many parts of the country. Wherever there is a group of Cornell Engineers (Civil, Mechanical, Electrical or Chemical), try to hold informal organization meetings. Anyone may start such a group. Write to Prof. John R. Bangs at Ithaca. He will be glad to help.

Let's make this another year of real growth.

John P. Syme '26
President

Raymond W. Kruse '41 A.E.

(*Continued from page* 16)

as President this year.

An outstanding personality is "Krause"—genial, affable, versatile, hard-working—and yet quite inexpressible through the pen in the hands of a biographer. Cornell looks for a great future for Ray—if his "activities curve" can be exterpolated in the same direction!

Alumni News . . .

(*Continued from page* 18)

Norman F. Bissell '27, president of the Cornell Club of New England, and Creed W. Fulton '09, president of the Alumni Association discussed plans early in September for the Alumni Convention to be held in Boston, November 14 to 16.

Delegates from most Cornell Clubs and the various alumni organizations will be present at the convention, however, all alumni have been invited to attend.

President Edmund Ezra Day and several nationally prominent alumni will speak.

John C. Antrim '41 A.E.

(*Continued from page* 17)

Engineer Antrim hopes to enter the foreign division of some company's organization. What this ambition can be attributed to is hard to determine, but it may be that his brother's connection with International General Electric has something to do with it. Jack's brother is also a Cornell graduate—an M.E. of 1938.

When questioned about his opinion of an Arts education and coeds, the diplomatic reply was, "I agree with the majority of engineers."

Home to this engineer-politician is Worthington, Ohio, a suburb of Columbus. On the campus, you can find him at Phi Delta Theta (that is, if you're lucky).

Stress and Strain

Student in Astronomy: "Has anything ever been discovered on Venus?"

Professor (whose mind has wandered): "No, not if the pictures of her are authentic."

—Missouri Shamrock

* * *

Young Lady: "I want a pair of shorts to wear around my gymnasium."

Clerk (absent-mindedely): "How large is your gymnasium?"

* * *

Room-mate: "Hey, Tom, wake up! There's a guy in your room stealing your clothes."

Second ditto: "What d'ya want to get me up for? You two just fight it out among yourselves."

* * *

Webster says that taut means tight. I guess I've been taut quite a bit in this school.

* * *

A Happy Medium is something two contending persons arrive at to their mutual satisfaction.

* * *

"And what do you do when you hear the fire alarm my good man?"

"Oh, I just get up and feel the wall and if it ain't hot I go back to bed."

* * *

We offer the one about the dumb pop who wanted his son to become a carpenter, so he sent him away to boarding school.

—Kansas State Engineer

* * *

A long wisp of artificial grain was the ornament on a girl's hat in the tramcar. It was placed horizontally, and it was tickling the face of a man who sat next to the wearer. Soon it came to rest in his ear.

The man took a huge claspknife from his pocket and began stropping it on the palm of his hand.

"Oh, what are you going to do?" cried the girl.

"If them oats gets in my ear again, miss," replied the victim, "there's going to be a harvest."

Professor Grantham was explaining the law of gravitation, and how it prevented people from falling off the earth.

When he had finished he invited questions from the class.

"Please sir," said one pupil, "what kept them on the earth before this law was passed?"

* * *

Collegian: "Jiggers, here comes a speed cop."

Second future filling station attendant: "Quick, hang out the Notre Dame pennant."

—Missouri Shamrock

* * *

We see by the papers that a man has been found who lives so far back in the hills that he has never seen Mrs. Roosevelt.

* * *

Visitor: "Does Mr. Burton, a student, live here?"

Landlady: Well, a Mr. Burton lives here, but I thought he was a night watchman."

* * *

Jack: "Only that little bit of jam for me?"

Mother: "That's not for you, that's for sister."

Jack: "What! All that for her?"

* * *

We understand that one of the boys over in the E. E. Department is trying to calculate what the speed of lightning would be if it didn't have to ziz-zag.

* * *

Pilot: "Say, look at the grotesgue insignia on the side of that bombing plane."

Co-pilot: "Shh! Not so loud. That's the squadron commander looking out of the window."

—California Engineer

* * *

A man had fallen into a manhole and called for help.

"Dear me," said a gentleman who happened along, "have you fallen into that manhole?"

"Not at all," was the reply. "Since you seem to be interested I will say that I just happened to be down here and they built the pavement around me."

Although any man can have a wife, only the iceman has his pick.

* * *

Mary had a little lamb,
Some salad and desert;
And then she gave the wrong address,
The dirty little flirt.

* * *

"Why is the black crepe on the door? Is somebody dead?"

"That's no crepe, that's my roommate's towel."

* * *

There are three kinds of co-eds:
(1) The beautiful
(2) The intelligent
(3) The majority

* * *

Captain: "So you are going to spend the rest of the day in a steamer chair."

Passenger: "Why yes, if nothing else comes up."

* * *

"Are you a professor?"

"No, I won this tie at a raffle."

* * *

Woman passenger looked up from a timetable and asked: "Why does it take us seventeen and a half hours to fly from New York to Los Angeles and only fifteen hours to fly from Los Angeles to New York?"

The hostess smiled sweetly and said "On the flights east we have a tailwind."

"Then why in the world," asked the passenger, "doesn't TWA equip all its airplanes with tailwinds?"

* * *

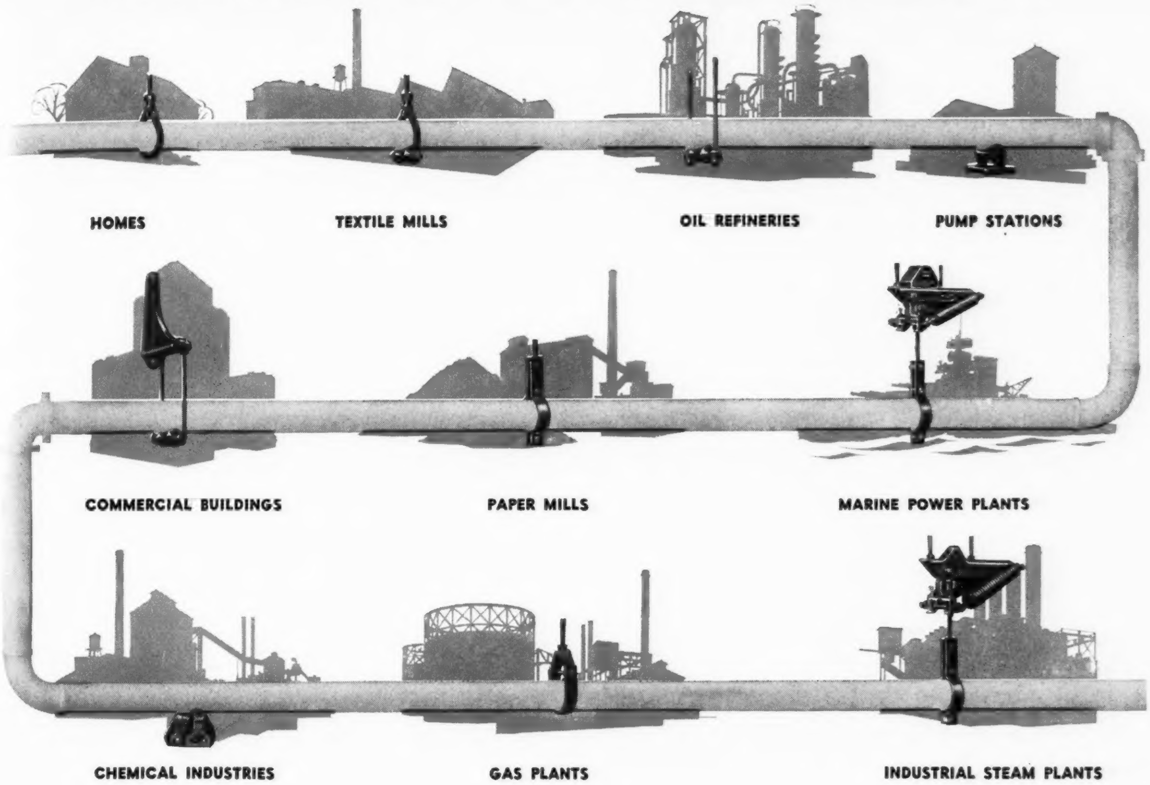
More than one hostess tells of a first-flighter, making a night hop, who noticed the tiny red light far out on the wing tip and asked what it was.

"That's a navigational light," the explanation went.

The passenger pointed to the green light on the other wing and asked what it was. The hostess explained that it, too, was a navagational light.

"Well, isn't that wonderful!" the passenger marveled. "All the pilot has to do is steer the plane between the two lights."

SCIENCE IN AN UNEXPECTED ROLE...



Pipe Hangers are now *Engineered* for each specific service

NO longer is pipe hanging a haphazard matter of fastening pipes "somewhere, out of the road." Every industry has individual requirements ... every type of system its vagaries At one extreme is the domestic water system involving chiefly dead weight. At the other, pulsing steam power lines where thermal-movement and vibration demand scientific control.

Until Grinnell engineers attacked these problems, pipe hanging was given little attention. Today, Grinnell produces adjustable hangers in thousands of combinations to hang *any* piping *anywhere*.

This is merely one example of improved services developed by Grinnell. Others include prefabricated piping, automatic sprinkler fire protection, Thermolier unit heaters, Amco industrial humidifiers, extra-quality pipe fittings. Write for reference folder on Adjustable Hangers or other Grinnell products. Grinnell Co., Inc., Executive Offices, Providence, R. I. Branch offices in principal cities of U. S. and Canada.

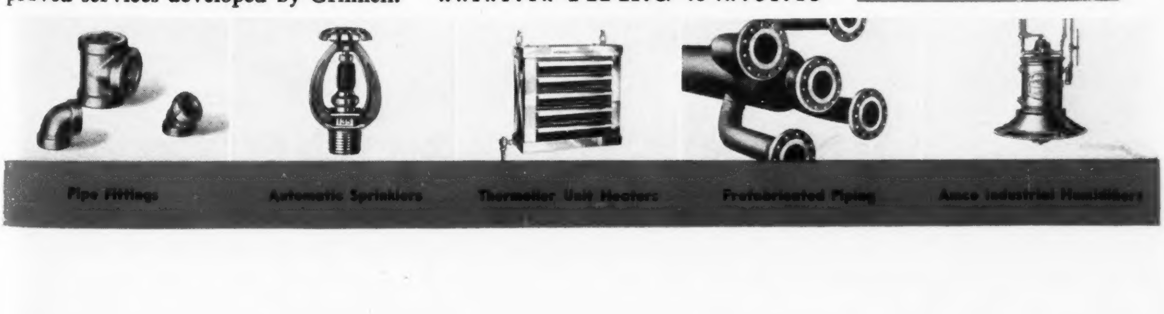
Grinnell Company, Inc. . . . Grinnell Company of the Pacific . . Grinnell Company of Canada, Ltd. . . General Fire Extinguisher Company . . . American Moistening Company . . . Columbia Malleable Castings Corporation . . . The Ontario Malleable Iron Company, Ltd.

GRINNELL

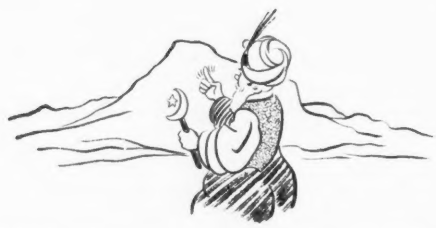
WHENEVER **PIPING** IS INVOLVED

Adjustable Hangers for all low-pressure piping.

Genspring Constant-Support Hangers for power piping.



G-E Campus News



"HITHER, MOUNTAIN!"

IT'S been centuries since Mahomet resigned himself to go to the mountain because the mountain wouldn't come to him. If Mahomet were living today, he wouldn't have to go to the mountain, that is, if he were at Shasta Dam—the second largest concrete dam in the world—now under construction in California.

There the world's longest conveyor belt is moving mountains—5,700,000 cubic yards of concrete and 10,400,000 tons of sand and gravel—from the processing plant to storage piles near the dam site, a distance of 9.6 miles.

Driving the conveyor belt are General Electric motors and control, thoroughly checked and tested before going on the job by young student engineers taking the G-E Test Course. J. A. Jackson, Va. Poly. Inst., '00, and R. F. Emerson, Yale, '06, had charge of the engineering at Schenectady, and A. W. Moody, U. of Calif., '36, followed engineering on the job. All three are ex-Testmen.

SUPER STREAMLINING

IN this modern age practically every means of transportation is streamlined—automobiles, airplanes, trains, and even baby carriages. The closest approach to perfect streamlining, however, is probably not found in any one of the foregoing but in a General Electric steam turbine, where nozzles must be designed to direct steam at the buckets at just the right angle.

G-E engineers have streamlined turbine nozzles to a point where they absorb less than two per cent of the velocity energy of steam traveling through turbines. Working with models, engineers about 20 years ago found they could feel low-pressure spots in an air stream blown through nozzle sections. Literally and figuratively they were "putting the finger" on streamlining deficiencies. Now, in a special laboratory, air is forced through model nozzles at a terrific speed (more than 700 miles an hour) while mechanical "fingers" feel for points of eddy or friction loss, and an automatic machine records the results.

These "streamline" tests, conducted by young student engineers "on Test" under the direction of experienced engineers, give records of inestimable value in the constant search for new ways to build more efficient turbines.

SIX VOICES

PEOPLE who have qualms about broadcasting probably would have passed right out if they had been in the shoes of George A. Mead, N. Y. State Commander of the American Legion, when he broadcasted recently from General Electric's television studios at Schenectady, N. Y.

For the first time in history a voice was carried over every practical means of voice communication. Mead's talk, in addition to going out on the ultra-short-wave band accompanying the picture on television, was simultaneously carried by WGY on long-wave radio, WGEO on short-wave, W2XOY on frequency modulation, and by light beam and ordinary telephone. In all, six distinct frequency bands carried his words to the four corners of the earth.

Directors of this unusual broadcast were John Sheehan, Union, '25, manager of G-E short-wave broadcasting, and J. G. T. Gilmour, Union, '27, program manager of G.E.'s television station, W2XB.

GENERAL ELECTRIC

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